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ABSTRACT

Math historian Morris Kline suggests that math instruction should be made concrete and that teachers should not turn kids off by making intuitively understood concepts complex through the use of fancy language. He advocates using pictorial representations and examples of actual physical occurrences. The dyslexic student has special difficulties in math which require even more teaching modifications. Gene Watson, a psychologist from Virginia, believes the problem is lack of training in teaching math and especially in teaching math to learning disabled students. A learning disabled student might have difficulty with sequencing, knowing left from right, borrowing, regrouping, and/or understanding the language of math. A study by Byron Rourke, psychology professor at the University of Windsor, Ontario, indicated that math learning problems are as various as dyslexias and may originate in different parts of the brain. Math specialist Joyce Steeves believes that the educational system creates much of the learning disabilities in math. Children should not be rushed into left brain tasks too early. A study by Dr. Steeves illustrates the difficulties of identifying mathematically gifted dyslexic students. Gifted dyslexics may score below average on computation, although they are on a par with gifted non-dyslexics on higher level abilities such as abstract reasoning. (DC)

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Math & the Dyslexic:
Making the Abstract Concrete

by
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MATH & THE DYSLEXIC:

1234567890 making the abstract concrete

"The teacher asks, 'Why is 2+3 = 3+2?'
'Because both equal 5.'
'No,' reproves the teacher, 'because the
commutative law of addition holds.' "

Math instruction has become a subject of national concern over the last several years in response to students' declining math achievement scores and the growing need for mathematically trained young people in scientific and technical fields.

Why do so many ordinary mortals (let's not even consider the special problems of dyslexics for the moment) back away from math with fear and trembling?

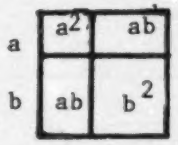
Math historian Morris Kline gives a wryly amusing and instructive account of why the traditional math, as well as the new math, failed with so many students in his book, Why Johnny Can't Add. Published in 1973, when the victims of the new math were accumulating on the battlefields of the modern classroom, his recommendations for reform are just as pertinent today to improving math teaching for all students, including dyslexics.

"Logic merely sanctions
the conquests of intuition."
Morris Kline, quoting mathematician
Jacques Hadamard

Kline suggests that the most important reform in teaching math would be to make it concrete and not turn kids off by making intuitively understood concepts complex through the use of fancy language. Professor Klein berates the use of language and unnecessary concepts that confound rather than impart understanding. For example, he considers the introduction of the distributive, commutative, and associative laws to be detrimental to teaching math to young students. He also decries the use of excessive symbols and terms in geometry and algebra that put "an intolerable burden on the memory."

"Math grew out of our experiences in the physical world," he writes, and "primarily one makes sense of mathematics through the senses."

To help bring math to the concrete level, Kline advocates using pictorial representations and examples of actual physical occurences to explain mathematical language, formulas, and operations. For example, the term "a^2" is so-called because it represents the area of a square whose side is "a" in length. $(a + b)^2 = a^2 + 2ab + b^2$ and not $a^2 + b^2$, which some students think is the logical extension of the term, because it represents the area of a square whose side is (a + b) in length.



Area= $a^2 + 2ab + b^2$

Kline contends that the format and content of math textbooks defeat good teaching because they are written by mathematicians who are not at all interested in, or knowledgeable about, the psychology of learning -- "a much more difficult subject than math."

Several sessions at the National Conference of the Orton Dyslexia Society held last year in Baltimore dealt with the teaching of math to dyslexics and covered in a more specialized way many of the issues addressed by Mr. Kline. Of course, the dyslexic student is further hindered in his study of math by the particular nature of his learning differences and requires even more modifications of the teaching process to learn effectively.

Gene Watson, a psychologist from Virginia, believes the crux of the problem is "the abysmal lack of training of teachers to teach math in general" and no training at all for teachers to teach math differently to the mathematically learning disabled. In his session on "Mathematics and the Dyslexic," Mr. Watson reported that in a review of over 4,000 articles on learning disabilities in the ERIC system he found only 2.6% that addressed the teaching of math. The Orton Dyslexia Society Bulletin through 1979 lists only 2 articles.

A student with learning disabilities

"Math grew out of our experiences
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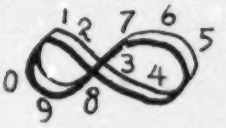

in math might have difficulty with sequencing, knowing left from right, borrowing, and/or regrouping. Fractions, decimals, and percentages are usually the most misunderstood of all elementary concepts.

Some dyslexic students have particular problems with the language of math. There is often confusion about the different ways math problems are spoken about and written about. Consider that the same problem may be expressed as: "take 15 into 105," "105 divided by 15," "15 divided into 105," or $105 \div 15$ or $15\overline{)105}$. In his practice, Mr. Watson drills students on math words while at the same time keeping the presentation and language consistent in the teaching process.

Byron Rourke, professor of psychology at the University of Windsor, Ontario, explored the relationship between mathematics, reading, and emotional disorders in a session entitled, "Neuropsychology of School Subjects: Problems of Categorizing Reading Disorders." Rourke's primary purpose was to suggest a new category of reading disorder, but his study also indicated that math learning problems are just as various as dylexias and may originate in different parts of the brain.

Rourke compared three groups representing three patterns of learning disability. Group 1 was uniformly deficient in reading, spelling, and math. Group 2 was deficient in reading and spelling, but slightly higher in math. Group 3 was very good in reading (word recognition) and spelling, and bad in math.

Groups 1 and 2 were inferior in psycholinguistic skills to Group 3, while Group 3 was deficient in complex motor tasks and tactile performance; therefore, Rourke postulates that Groups 1 and 2 have a relatively "bad" left hemisphere, while those in Group 3 have a relatively "bad" right hemisphere. Group 2 is poor in math because of poor memory and language difficulty, a left hemisphere problem, while Group 3 has difficulty with alignment and any novelty in visual-spatial presentation, a right hemisphere problem.

Group 3's high scores in reading comprehension and spelling reflect their excellent visual memories because, according to Rourke, 75% of what is tested under the name of reading comprehension is not comprehension, but memory.

Rourke thinks that Group 3 represents another kind of reading disorder, a hyperlexia with excellent word recognition, but almost zero comprehension. In testing, math seems to be Group 3's only problem, but in life these youngsters have social problems, are not good in sports, and become loners. They may have an unusually rich verbal fantasy life and may talk incessantly (the so-called "motor-mouth"), which may lead to a classification of schizoid at about age nine or ten.

Rourke emphasized that this Group requires the earliest intervention by a direct attack on their tactile and motor deficits. In math, they need help with laying out problems spatially.

Joyce Steeves, math specialist at the Jemicy School, believes the educational system creates much of the learning disabilities in math. She talked at length in her session on "Multisensory Math" about the many right-brained measuring, ordering,

"If judged on the basis of the usually tested skills, such as computation, the mathematically-gifted dyslexic will be invisible..."

and classifying skills a child needs in order to learn math in the elementary school years. Children need to be allowed to practice these skills and not rushed into left-brained tasks too early. She believes that many students collapse at the 4th or 7th grade because of lack of understanding of earlier arithmetic skills.

Dr. Steeves uses concrete items, such as blocks and cuisinaire rods, to illustrate physically the meaning of math concepts, and also employs rhymes, songs, and mathematical games to aid memory and increase teaching effectiveness.

A study by Dr. Steeves of 130 "pure" dyslexics illustrates the difficulties of identifying the mathematically gifted dyslexic student. When mathematically gifted dyslexics were compared with mathematically gifted non-dyslexics in abstract reasoning, the two groups were on

(continued on page 3)

Math (continued from page 7)

a par. On computation tests, the gifted dyslexics scored about the same as mathematically average non-dyslexics, while on memory tests the mathematically gifted dyslexics scored below the average non-dyslexics. From these results it is obvious that if judged on the basis of the usually tested skills, such as computation, rather than on higher level abilities such as abstract reasoning, the mathematically gifted dyslexic will be invisible, or even perceived as below average.

The spirit of educational reform is in the air. Whether that heady stuff becomes substance remains to be seen. In the meantime, as we continue to work towards the inclusion in the nation's schools of educational methods that honor learning differences, let us keep in mind that difficulty with math is included in the definition of dyslexia.

(See Joyce Steeves, page 4) -- Kay Kitzen

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